



Contents lists available at ScienceDirect

Quaternary Science Reviews

journal homepage: www.elsevier.com/locate/quascirev

Woodlands and steppes: Pleistocene vegetation in Yakutia's most continental part recorded in the Batagay permafrost sequence

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ARTICLE INFO

Article history:

Received 26 January 2018

Received in revised form

20 July 2018

Accepted 20 July 2018

Available online 1 August 2018

Keywords:

Palaeo-vegetation

Plant macrofossils

Invertebrates

Modern analogues

Pollen

Ground squirrel nest

Last cold stage

Eemian

Beringia

ABSTRACT

Based on fossil organism remains including plant macrofossils, charcoal, pollen, and invertebrates preserved in syngenetic deposits of the Batagay permafrost sequence in the Siberian Yana Highlands, we reconstructed the environmental history during marine isotope stages (MIS) 6 to 2. Two fossil assemblages, exceptionally rich in plant remains, allowed for a detailed description of the palaeo-vegetation during two climate extremes of the Late Pleistocene, the onset of the last glacial maximum (LGM) and the last interglacial. In addition, altogether 41 assemblages were used to outline the vegetation history since the penultimate cold stage of MIS 6. Accordingly, meadow steppes analogue to modern communities of the phytosociological order *Festucetalia lenensis* formed the primary vegetation during the Saalian and Weichselian cold stages. Cold-resistant tundra-steppe communities (*Carici rupestris-Kobresietea bellardii*) as they occur above the treeline today were, in contrast to more northern locations, mostly lacking. During the last interglacial, open coniferous woodland similar to modern larch taiga was the primary vegetation at the site. Abundant charcoal indicates wildfire events during the last interglacial. Zoogenic disturbances of the local vegetation were indicated by the presence of ruderal plants, especially by abundant *Urtica dioica*, suggesting that the area was an interglacial refugium for large herbivores. Meadow steppes, which formed the primary vegetation during cold stages and provided potentially suitable pastures for herbivores, were a significant constituent of the plant cover in the Yana Highlands also under the full warm stage conditions of the last interglacial. Consequently, meadow steppes occurred in the Yana Highlands during the entire investigated timespan from MIS 6 to MIS 2 documenting a remarkable environmental stability. Thus, the proportion of meadow steppe vegetation merely shifted in response to the respectively prevailing climatic conditions. Their persistence indicates low precipitation and a relatively warm growing season throughout and beyond

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